Title: Ocean Speedway

Brief Overview:

This unit involves the design and construction of a mini-car oval speedway. Students will use rulers, compasses, protractors, and other materials to make a two-dimensional model of an oval track, safety fence, ticket booth, and refreshment stand. This unit involves estimating and determining the perimeter and area of the track. Students will be asked to determine cost factors and to communicate both findings written and oral findings.

Links to Standards:

- **Mathematics as Problem Solving**
  Students will demonstrate their ability to solve problems in mathematics including problems with open-ended answers, problems which are solved in a cooperative atmosphere, and problems which are solved with the use of technology.

- **Mathematics as Communication**
  Student will demonstrate their ability to communicate mathematically. They will read, write and discuss mathematics with language and the signs, symbols, and terms of the discipline.

- **Mathematics as Reasoning**
  Student will demonstrate their ability to reason mathematically. They will make conjectures, gather evidence, and build arguments.

- **Mathematical Connections**
  Students will demonstrate their ability to connect mathematics topics within the discipline and with other disciplines.

- **Estimation**
  Students will demonstrate their ability to apply estimation strategies in computation, with the use of technology, in measurement, and in problem solving. They will determine reasonableness of solutions. Students will demonstrate their ability to solve problems using arithmetic operations, with technology where appropriate.

- **Number & Number Relationships**
  Students will demonstrate their ability to describe and apply number relationships using concrete and abstract materials.

- **Concepts of Whole Number Operations**
  Students will choose appropriate operations and describe effects of operations on numbers.

- **Geometry and Spatial Sense**
  Students will demonstrate their ability to apply geometric relationships using one and two dimensional objects. They will demonstrate congruency, similarity, symmetry, and reflection and apply these concepts to the solution of the geometric problems.

- **Measurement**
  Students will demonstrate and apply concepts of measurement using nonstandard and standard units and metric and customary units. They will estimate and verify measurements. They will apply measurement to interdisciplinary and real-world problem solving.

- **Fractions and Decimals**
  Students will utilize knowledge of decimals and numbers to solve problem situations.

- **Patterns and Relationships**
  Students will demonstrate their ability to recognize numeric and geometric relationships and will generalize a relationship from data.

Grade/Level:

Grades 4-5

Duration/Length:

This unit will take approximately three 60 minute class periods.

Prerequisite Knowledge:

Students should have working knowledge of the following:

- Estimating
- Measuring to the nearest centimeter
- Calculating area and perimeter of regular shapes
- Using a compass, a protractor and a ruler
- Multiplication, money values
- Using ratios and scale
- Diameter, radius, and circumference

Objectives:

Students will:

- construct designated circles and rectangles to size.
- calculate the area and perimeter of a irregular shape.
- construct angles.
- compare measurements using scale.
- construct two-dimensional model.
- calculate cost.
- provide written and oral feedback.
- work individually and with cooperative pairs.

Materials/Resources/Printed Materials:

- Construction paper
- Compasses, centimeter rulers, protractors
- Yarn, scissors, tape, string, glue
- Resource Book and response book

Development/Procedures:

Day 1:

- Teacher and students will read opening vignette in Student Resource Booklet page 1.

- Discuss the term oval and what corresponding shapes are used to make an oval speedway.

- Students will work in pairs to investigate shapes within the oval and construct several examples in Student Response Booklet page 1.

- Use Student Resource Booklet, Page 1, and follow the directions to construct model of oval track.

- Students will investigate how to find the perimeter of an irregular shape utilizing the Student Resource Booklet, page 1.

- Communicate responses in written form and provide oral feedback to class.

- Using yarn, create a fence on model and calculate cost factor based on information from response booklet, page 2.

Day 2:

- Teacher conducts a performance lesson for finding an area of a circle utilizing teacher resource booklet, page 1.

- Calculate the infield area of the track for placement of sod utilizing Student Response Booklet page 2.

- Construct ticket booth following directions in Student Resource Book, Page 1.

- Construct angles within a circle and in writing list relationships. Follow directions Student Resource Booklet page 2 and Student Response Booklet page 2.

Day 3:

- Construct a refreshment stand and parking area following directions in Student Resource Book, Page 2.

- Write explaining the reasons for placement of items on speedway and give suggestions for additional facilities with supportive reasoning. Follow activity Student Response Booklet page 3.

Performance Assessment:

The teacher can use a variety of assessments to evaluate the students. First, observe student's participation in group activity and individual participation in class. Second, the student response booklet can be scored and graded for correct reasoning, estimating and mathematical computations. Finally, use the writing rubric to score all written responses within this task.

Extension/Follow Up:

- Field trip to Go-Kart facility.
- Invite architects to discuss design and implementation.
- Invite general and/or subcontractors to discuss cost and bidding for particular jobs or job sites.
- Construct a three dimensional model, i.e. prisms, cylinders, etc.
- Create other track designs with a variety of geometric shapes.
- Contact local extension office regarding land development and environmental concerns.

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Student Resource Booklet Page 1

You have been hired by the Fun World Company to design a go kart speedway for their new complex located in Ocean City, Maryland. They have asked you to design an oval track course for the karts to run on. Your design must also include the ticket booth, restroom - refreshment building and parking lot. They have also asked you to calculate the cost of certain parts of the construction to give them an approximate cost of the project.

Go to page one of the Student Response Booklet and complete Activity A.

Directions for track construction in cooperative pairs:

The scale for your model is **1 cm = 10 m**

First draw a circle with a 10 cm radius on the construction paper provided. Then using the same center point draw a second circle within the first with a 6 cm radius. Use a ruler and draw one diameter through the 10 cm radius circle and then using scissors cut the circle in half along the line drawn for the diameter.

Next construct a rectangle with a length of 20 cm and a width of 10 cm. Then using tape connect the two half circle ends to the rectangle to form the shape of the speedway. The last step is to use a ruler and draw the infield lines for the two straightaways completing the oval shape track.

Go to page one of the Student Response booklet and complete Activity B.

Using a ruler and yarn, measure the amount you will need to represent your fence and glue it to the outside edge of the speedway track.

The owners of Fun World have asked you to determine the cost of certain construction items. The safety fence is one of those items. The fence cost $2.05 per meter installed.

Go to page two of the Student Response Booklet and complete Activity C.

The infield area of the track needs to be determined to lay sod on it. To do this you must know how to find the area of a circle.

Working with your teacher you will complete Activity D Student Response Booklet.

The ticket booth has to be a circle in shape. The radius of the circle is 3 cm. Use your tools and construction paper and make a model of the ticket booth.

The ticket booth is divided equally into 4 parts.

Go to page two of the Student Response Booklet and complete Activity E.

A refreshment/restroom building needs to be designed. The dimensions of the building are 2 cm by 4 cm. Using your tools and construction paper make a model of the refreshment building.

The parking lot needs to be 30 sq cm in area.

Go to page 2 Student Response Booklet and complete activity F.

Using your four models, oval track, ticket booth, refreshment/restroom facility and parking lot, arrange and create your representation of Ocean Speedway. After arranging items, glue onto paper to present to the owners of Fun World.

Go to page 3 Student Response Booklet and complete activity G.

Student Response Booklet Page 1

Activity A
   You have to design an oval track. In the space below draw several examples of an oval shape. With your partner discuss what shapes are used together to make an oval speedway.

Activity B
   A safety fence is required to keep unwanted things off the track. To determine the amount of fencing that will be needed you must determine the perimeter of the track.

1. Explain how you can find the perimeter of the track using only the ruler and piece of yarn provided.

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2. Now, using what you have discovered estimate the perimeter in meters: REFER TO STUDENT RESOURCE BOOKLET FOR SCALE

   _____

3. Find the approximate perimeter of the track in meters and include a number sentence to show how you determined your answer.

Activity C
   What is the cost of safety fencing installed? Include a number sentence to explain your answer.

Activity D
   The formula for the Area of a Circle is 3.14 X r X r (r = radius) i.e.: circle with a 5 cm radius has area 3.14 X 5 X 5 = 78.50 sq. cm.
Solve the following:

r = 2 cm   A = _____   r = 4 cm   A _____

r = 10 cm   A = _____   r = 6 cm   A _____

   Now you know how to calculate the area of a circle. Use your track model to find the total infield area. Explain how you determined your answer.

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Activity E
   The ticket booth is divided into four equal parts. Use your ruler and draw one diameter on your model. Use your tools and construct a diameter perpendicular to the first diameter.
What is the measurement of each of these angles?_____
   Look at your ticket booth. Below list all the words or phrases you can think of to describe your ticket booth (i.e., two diameters are drawn).

_____

_____

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Activity F

The parking lot is 30 sq. cm. in area. Below write all the number sentence combinations that would make the area 30 sq. cm.

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Now, look at your responses and choose one of the possible combinations and construct with partner.

Activity G

Explain the placement of each item on the paper. Then suggest other possible additions to your design that would make Ocean Speedway the best in the world. REMEMBER TO INCLUDE AT LEAST ONE REASON FOR EACH OF YOUR SUGGESTIONS

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Activity A

The object is to lead the students in a discovery of the different shapes that are contained in a basic oval speedway shape. Give them time to explore in their response booklet individually as well as in pairs. Then share as a group their discoveries. The goal is to have them realize that an oval speedway is a combination of one circle split in half connected in the middle by a rectangle.

Directions for track construction:
Teacher will direct the construction of the track to the class in cooperative pairs. This includes demonstrating how to construct the circles and rectangle. Also assist in the assembly of the track.

Activity A Rubric:

2	Student constructs several examples of ovals.
1	Student constructs one example of an oval.
0	Student is unable to construct an oval shape and/or no response.

Activity B

Allow the students time to explore, using the tools provided, to determine how they could find the perimeter using only these items. You can at this time have a group discussion about what they have found. Let them then complete parts two and three in their pairs.

Activity B Rubric:

2	Student explanation includes all required parts.
1	Student explanation includes two out of three required parts.
0	Student is unable to provide an explanation of required parts.

Activity C

Allow students to calculate the cost of the fencing individually.

Activity C Rubric:

2	Student fully explains answer and includes number sentence.
1	Student does not include number sentence or does not fully explain cost.
0	Student does not answer required parts.

Activity D

Assist the students with the calculations of the area of a circle and provide a visual model/s. Calculators can be used for this part. Check answers and make sure they know how to determine the area.

Explanation should include two different shapes require two different methods to find the area and the two measurements need to be combined to obtain the final answer. i.e.: the area of the circle + the area of the rectangle.

Activity D Rubric:

> **2**   Student answers all required parts correctly
> **1**   Student answers only a portion of required parts
> **0**   Student does not answer required parts

Activity E

Students need to construct the four equal parts of the ticket booth. In the explanation they can include similarities and differences.

Activity E Rubric:

> **2**   Student is able to correctly construct and measure angles and provide three explanations of the construction of the ticket booth. (See examples).
> **1**   Student answers a portions of the required parts.
> **0**   Student is unable to answer required parts.

Activity F

Students will identify all possible combinations for the design of the parking lot. Then they will construct the model of the parking lot.

Activity F Rubric:

> **1**   Student will provide three number sentence combinations.
> **0**   Student is unable to provide an answer to the question.

Activity G

Students will arrange their model pieces to create the go kart facility on a large piece of paper and then will write to inform explaining their choice of positioning and to suggest and support additions.

Writing Response Rubric:

3   Student responds to all parts of question with complete, well-developed answers. Student uses information gained in activities to support their answers. Correct spelling, punctuation, grammar, and sentence structure are used.

2   Student responds to all parts of question, but answers are incomplete and not well-developed. Student's answers are only partially supported with information gained in activities. Few errors in spelling, punctuation, grammar, and sentence structure.

1   Student's response in incomplete and not supported with information gained in activities. Many errors in spelling, punctuation, grammar and sentence structure.

0   No response.

Daily procedure:

Day 1: Complete Activities A through C

Day 2: Complete Activities D and E

Day 3: Complete Activities F and G